



Research Article

EFFECT OF MCKENZIE IN PATIENTS WITH ADHESIVE CAPSULITIS ON PAIN, RANGE OF MOTION AND DISABILITY - A RANDOMIZED CONTROL TRIAL

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ABSTRACT

Aims: To assess the effect of McKenzie exercise on pain, range of motion and disability in patients with adhesive capsulitis.

Objectives: To diagnose adhesive capsulitis using stage classification, to assess pain using visual analogue scale, to assess range of motion using universal goniometer, to assess disability using shoulder pain and disability index.

Background: Adhesive capsulitis is also known as frozen shoulder is common condition which involves pain in the glenohumeral joint followed by loss of motion. Adhesive capsulitis is classified as primary and secondary. The McKenzie method of Mechanical Diagnosis and Therapy is well known and commonly applied in the management of spinal disorders by Robin McKenzie.

Results and Conclusion: Data was collected and analyzed. Parametric and non-parametric test were used according to normality test. Statistically significant was seen in range of motion flexion, external rotation, internal rotation was seen. VAS and SPADI were equally significant. P value <0.05. This study concludes that McKenzie exercise along with convention exercise is effective in increasing range of motion and reducing disability compared to control group. McKenzie exercise with conventional exercise and conventional exercise are both effective to reduce pain.

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INTRODUCTION

Adhesive capsulitis is also known as frozen shoulder is common condition which involves pain in the glenohumeral joint followed by loss of motion.^[3] Codman was first to introduced the term frozen shoulder in 1934.^[4] Current guidelines define adhesive capsulitis as a progressive pain syndrome with decreases in both active and passive ranges of motion of the glenohumeral joint.^[5,6] Adhesive capsulitis has incidence of 3–5% in the general population. It is one of the most common musculoskeletal problems seen in orthopaedics.^[7-11] Adhesive capsulitis is classified as primary and secondary. Primary, which is insidious and idiopathic, and secondary, which is generally due to trauma or subsequent immobilization.^[12] Those with primary adhesive capsulitis generally have gradual onset and progression of symptoms, with no known precipitating event that can be identified.^[13] The onset is insidious and usually occurs between age of 40-60 years.^[14] The diagnosis of adhesive capsulitis is often made clinically and coincides with the gradual onset of shoulder pain and limited ROM.^[15]

The four stages of adhesive capsulitis disease progression initially defined by Neviaser in 1945^[16] stage one characterized by a gradual onset of pain that increases with movement and is present at night loss of external rotation motion the duration of this stage is usually less than 3 months. Stage two (freezing stage) characterised by persistent and more intense pain at rest motion is limited in all direction typically between 3 and 9 months. Stage three (frozen stage) characterised by pain only with movement significant adhesion and limited glenohumeral motion with substitute scapula motion last between 9 and 15 months. Stage four (thawing stage) characterised by minimal pain and significant capsular restriction from adhesion, motion improves gradually last from 15 to 24 months.^[14]

Pain associated with adhesive capsulitis causes limitation or immobilization of the painful shoulder. Immobilization for prolonged period can cause several detrimental pathophysiologic findings including: capsular thickening decreased collagen length, ligament atrophy resulting in decreased stress, collagen band bridging across recesses, absorption fibrofatty infiltration into the capsular recess, random collagen production.^[17]

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Adhesive shoulder capsulitis is clinical diagnosis made on the basis of medical history and physical exam and is often diagnosis of exclusion. Other causes of a painful stiff shoulder must be excluded before a diagnosis of adhesive capsulitis is rendered, including septic arthritis, mal-position of orthopaedic hardware, fracture malunion, rotator cuff pathology, glenohumeral arthrosis or cervical radiculopathy. Clinically, patients first present with shoulder pain followed by gradual loss of both active and passive range of motion (ROM) due to fibrosis of the glenohumeral joint capsule.^[18]

Contracture of the glenohumeral capsule is the hallmark of adhesive capsulitis. Findings include loss of the synovial layer of the capsule, adhesions of the axillary to itself and to the anatomical neck of the humerus, and overall decreased capsular volume.^[18] A contracted CHL is considered the essential finding in adhesive capsulitis.^[19]

The McKenzie method of Mechanical Diagnosis and Therapy (McKenzie 1981, 1990; McKenzie and May, 2000, 2003) is well known and commonly applied in the management of spinal disorders by Robin McKenzie. The system uses a mechanical evaluation involving repeated end-range movements performed whilst the symptom and mechanical response are monitored. The effect of the repeated movements is then used to classify patients in one of three mechanical syndromes: derangement, dysfunction, and postural syndrome.^[20] McKenzie proposed that this system of diagnosis and treatment could also be applied to extremity disorders. According to McKenzie, patients with extremity disorders can be classified into the following four syndromes.^[21]

Derangement syndrome: identified by a rapid response to a direction-specific loading strategy, known as the directional preference. A lasting improvement in symptoms, range of motion, and enhanced function will be achieved once the directional preference has been established and utilized.

Articular dysfunction: distinguished by intermittent and consistent pain only produced at a diminished end range with a slower response to specific tissue loading strategy.

Contractile dysfunction: distinguished by intermittent pain consistently produced, but this time only when the Musculo-tendinous unit is loaded, for instance, with an isometric contraction against resistance.

Postural syndrome: intermittent pain only produced by prolonged postures that, once avoided, result in a return to a normal pain-free state. The remainder of the physical examination is normal.

Other:

patients who are not classified under any of the mechanical syndromes. Examples trauma, articular structurally compromised, recent surgery, and chronic pain syndrome. Adhesive capsulitis comes under other classification according to MDT classification for extremities.^[21]

The VAS is a unidimensional measure of pain intensity, which has been widely used in diverse adult populations, including those with rheumatic diseases. It is a continuous scale of 10 centimetres (100 mm) in length, no pain (score of 0) and pain as bad as it could bear worst imaginable pain. Test-retest reliability has been shown to be good, higher among literate ($r=0.94$, $P<0.001$) than illiterate patients ($r=0.71$, $P<0.001$). The

correlation between vertical and horizontal orientations of the VAS is 0.99.^[22]

The Shoulder Pain and Disability Index (SPADI) was developed to measure shoulder pain and disability. It contains 13 items that assess two domains; a 5-item subscale that measures pain and an 8-item subscale that measures disability. It showed reliability coefficients of $ICC \geq 0.89$ in a variety of patient population. Internal consistency is high with Cronbach α typically exceeding 0.90. The SPADI demonstrates good construct validity, correlating well with other region-specific shoulder questionnaires.^[23]

Need of study: McKenzie method of mechanical diagnosis is proved to be effective for spinal problems. McKenzie method is also applied for extremities but there are few case studies done on shoulder pain using McKenzie method of mechanical diagnosis and therapy. There is dearth of literature to assess the effectiveness of McKenzie in relieving the symptoms in adhesive capsulitis and to the best of our knowledge there are few studies undertaken to evaluate the effectiveness of McKenzie in stage ii adhesive capsulitis patients. To our best knowledge there is no randomized control trial study done using McKenzie method on adhesive capsulitis.

Hence the purpose of the study was to assess whether McKenzie therapy have an effect on pain, range of motion and disability in individuals with adhesive capsulitis.

Aims: To assess the effect of McKenzie exercise on pain, range of motion and disability in patients with adhesive capsulitis.

Objectives: To diagnose adhesive capsulitis using stage classification, to assess pain using visual analogue scale, to assess range of motion using universal goniometer, to assess disability using shoulder pain and disability index.

Research question: Is McKenzie exercise effective on pain, range of motion and disability in patients with adhesive capsulitis?

MATERIAL AND METHODOLOGY

Study Design

Type of Study: Interventional

Duration of Study: 12 months

Place of Study: OPD of metropolitan city

Sample Design

Sample Size: 64

Sampling: Simple Random sampling by lottery method

Sample Population: Patients with adhesive capsulitis

Selection criteria

Inclusion criteria

1. Subjects willing to participate
2. Clinically diagnosed with adhesive capsulitis
3. Age group of 40-60 years.

Exclusion criteria

1. Subjects not willing to participate
2. Subjects having Rotator Cuff Tear
3. History of Rheumatic Arthritis

4. Peri-arthritis secondary to fracture, dislocation
5. Reflex Sympathetic Dystrophy, or any Neurological condition,
6. Patients with Thoracic Outlet Syndrome, Peripheral Nerve Injury.
7. Any shoulder surgery

Material Used: Pen, paper, universal goniometer

Outcome Measures: Visual Analogue Scale, Shoulder Pain and Disability scale.

Procedure: Prior to starting the study Approval from the ethical committee was taken. Participants were selected as per the inclusion criteria and those not fitting were excluded from the study. Subjects were explained in the best language understood and a written consent was taken. Subjects were randomly allocated into 2 groups by simple random sampling by lottery method. Subjects were blinded to treatment protocol. Demographic data was collected from them. Pre-values and post-values of visual analogue scale, range of motion, shoulder pain and disability index were taken. Treatment was given for 3 sessions per week for 4 weeks.

Group A: McKenzie with conventional treatment (experimental group)

Group B: Conventional treatment (control group)

McKenzie exercises

Hand behind The Back With Overpressure: The subject is in standing position. The subject is instructed to take the affected shoulder at the back and then the therapist applied over pressure in an upward direction in the available end range. Dosage: minimum of 10 -12 repetitions.



Figure 1

Repeated Shoulder Extension With Overpressure: Subject is instructed to be in standing position. Subject is asked to do repeated shoulder extension movements till the end range and then overpressure was applied by the therapist at the end ranges. Dosage: minimum of 10-12 repetitions.



Figure 2

Shoulder Flexion Overpressure: Subject is in standing or sitting position. Subject was asked to do flexion till the end range repeatedly until it is a pain free movement, at the end range therapist applied overpressure. Dosage: minimum of 10-12 repetitions.

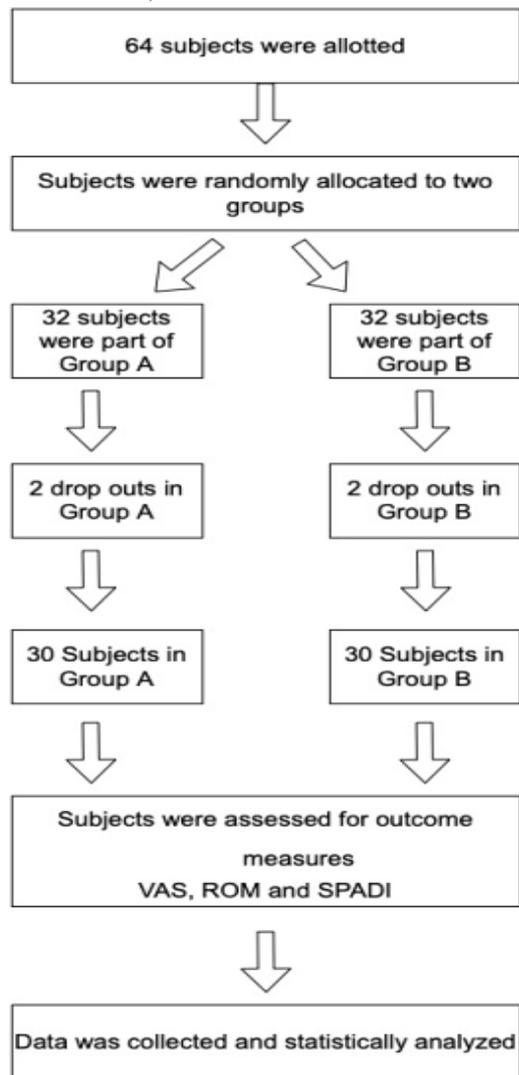


Figure 3

Conventional treatment

Hot pack for 10 minutes on affected shoulder finger ladder: for shoulder flexion and abduction 10 repetitions Codman's exercise: Bend forward at the waist, (back parallel to ground is ideal). Allow involved arm to hang perpendicular to the floor. Keep arm and shoulder muscles relaxed. Move arm slowly, increasing the arc as tolerated. This technique should cause only minimal pain. 10 repetitions each.

Active assisted ROM exercises of shoulder joint 10 repetition each (Wand Exercise).



Statistical Analysis and Results

The data was analyzed using the statistical package for social science (SPSS) software version 19. The data on categorical variables is shown as n (number of individuals) and the data on continuous variables is presented as Mean and Standard Deviation (SD) across. Descriptive data analysis for age was done and the Mean and Standard Deviation (SD) was calculated. Data was tested for normality using the Shapiro Wilk Test. Parametric tests were used to test data passing normality and non-Parametric tests were used to test data not passing normality. The Intra-group statistical comparison of distribution of variables is tested using Wilcoxon signed rank test for non-parametric and paired t test for parametric data. The Inter-group statistical comparison of variables is done using Mann Whitney U test for non-parametric data and independent t test for parametric data. All the results are shown in tabular as well as graphical format to visualize the statistically significant differences clearly.

In the entire study, the p value less than 0.05 are considered to be statistically significant.

A total number of 60 subjects with adhesive capsulitis were studied on pain, range of motion and disability out of which 25 were males and 35 were females. They were allotted into two

groups: Group A McKenzie (n=30) and Group B control group (n=30)

In SPADI, Active Flexion, Active Extension the data was normally distributed hence parametric test were used for inter and intra analysis.

Demographic Data **Table 1**

Characteristics	Group A	Group B
Age	52.3 ± (6.37)	48.9±(5.64)
Gender(M/F)	13/17	12/18
Affected side(L/R)	10/20	14/16
Stages (1/2/3)	2/19/9	2/18/10

The demographic data passed the normality test and is equally distributed.

Table 2 Baseline data pre values comparison of both the groups

Variable	Group A (mean)	Group B(mean)	P value
VAS	6±1.38	6.1±1.55	.689
SPADI	75.33±12.16	75.43±10.18	.310
Flexion active	122.7±3.86	119.9±5.50	.099
Flexion passive	126.7±3.73	125.1±5.45	.471
External rotation active	32.3±5.94	29.8±6.78	.142
External rotation passive	36.7±5.74	34.5±6.68	.191
Internal rotation active	30.3±7.25	27.5±6.71	.144
Internal rotation passive	35.2±7.79	32.1±6.51	.179
Extension active	39±4.13	33.27±4.31	.582

The pre values of variables VAS, SPADI, ROM of shoulder joint Flexion Active and Passive, External Rotation Active and Passive, Internal Rotation Active and Passive and Extension Active shows they are not significant hence baseline is equal therefore the comparison of pre- and post-value of these variables are done.

The pre value for shoulder Abduction Active and Passive and Extension Passive Showed Significance Abduction Active (P Value .005), Passive (P Value .015), And Extension Passive (P value.001) as the pre baseline value is significant comparison of pre post values of this variables cannot be done.

Table 3 Comparison of VAS within group A and group B Pre post data did not passed normality test hence non-parametric Wilcoxon test is used

VAS	GROUP A	GROUP B	P VALUE
PRE	6±1.38	6.1±1.55	0.000
POST	4.8±1.05	5.2±1.41	0.000

Interpretation: Table 3 shows statistically significant reduction (p<0.05) in VAS in both the groups. The comparison of between the groups for VAS showed equal significant p value .261 which shows that McKenzie exercise is equal to conventional exercise for reducing pain on VAS.

Table 4 Comparison of SPADI within group A and group B Pre post data passed normality test hence parametric paired t test is used.

VAS	GROUP A	GROUP B	P VALUE
PRE	75.33±12.16	75.43±10.18	0.000
POST	68.83±13.37	73.23±10.15	0.000

Interpretation: Table 4 shows significant reduction in SPADI in both groups (p=0.000) p<0.05. The comparison of between the groups for SPADI showed equal significant p value .169 which shows that McKenzie exercise is equal to conventional exercise for reducing pain on SPADI.

Interpretation: Table 5 shows mean and SD of range of motion of shoulder for both the groups. The p value for within the group A and group B shows statistical significance P value < 0.05. the data shows that group A is more significant than group B in comparison to flexion, external rotation, internal rotation. There is no statistical significance in extension between group A and group B.

Inter group comparison of external rotation both active and passive showed group A is effective than group B. The active range of motion of internal rotation in group A pre mean (30.3) improve to post (35.7) showed significant effect and in group B pre mean (27.5) improved to post (28.9) showed significant effect, similarly passive range group A pre mean (35.2) improved to (39.1) and group B pre mean (32.1) improved to post (32.7) showed significant effect

Table 5 Comparison of Shoulder Range of Motion Flexion, External Rotation, Internal Rotation (Active and Passive) And Extension Active

Rom (Range of Motion)		Group A		P Value	Group B		P Value	P Value
		PRE(MEAN±SD)	Post(MEAN±SD)	Within Group	PRE(MEAN±SD)	POST(MEAN±SD)	Within Group	Inter Group
Flexion	Active	122.7±3.86	126.9±3.63	0.000	119.9±5.50	121.8±6.33	0.000	0.008
	Passive	126.7±3.73	131.5±3.6		125.1±5.45	126.4±5.94		
External rotation	Active	32.3±5.94	36.5±5.86	0.000	29.8±6.78	31.7±6.79	0.000	0.008
	Passive	36.7±5.74	40±7.1		34.5±6.68	34.7±6.77		
Internal rotation	Active	30.3±7.25	35.7±7.72	0.000	27.5±6.71	28.9±7.16	0.000	0.002
	Passive	35.2±7.79	39.1±7.91		32.1±6.51	32.7±7.06		
Extension	Active	39±4.13	42.5±4.10	0.000	33.27±4.31	35.87±4.40	0.000	0.552

DISCUSSION

The present study was conducted to study the effect of McKenzie exercise and conventional treatment on pain, range of motion and disability in subjects with adhesive capsulitis.

Overall result of the study showed that GROUP A (McKenzie exercise and conventional) and GROUP B (convention exercise) demonstrated reduce in pain intensity measured by VAS. The inter group comparison showed that both groups are equally effective to reduce pain on VAS. Reduce pain in both the groups can be because of hot packs.

Effect of hot pack on relief of pain is due to nerve stimulation and increase in metabolism, there is dilation of small blood vessels which increases the local blood flow, the cutaneous heat receptors which gives analgesic and sedative effect.^[39]

SPADI measures disability of shoulder joint which showed reduced functional disability in group A pre mean (75.3) improved to post (68.83) compared to group B pre mean (75.4) improved to post (73.23).

Inter group comparison of SPADI showed that both groups are equally effective. Results of range of motion of shoulder joint (flexion, abduction, external rotation, internal rotation, extension).

The active range of motion of flexion in group A pre (122.7) improved to post (126.9) showed significant effect and in group B pre mean (119.9) improved to post (121.8) showed significant effect, similarly passive range showed significant effect in group A pre (126.7) improved to post (131.5) and in group B pre mean (125.1) improved to post (126.4) showed significant effect. Inter group comparison of flexion ROM both active and passive showed that group A is effective than group B.

The active range of motion of external rotation in group A pre mean (32.3) improved to post (36.5) showed significant effect and in group B pre mean (29.8) improved to post (31.7) showed significant effect, similarly passive range group A pre mean (36.7) improved to post (40) showed significant effect and group B pre mean (34.5) post (34.7) showed not significant.

Inter group comparison of internal rotation both active and passive short group it is effective than Group B.

The active range of motion of extension in group A pre mean (39) improved to post (42.5) showed significant effect and in group B pre mean (33.27) improve to post (35.87) showed significant effect.

Inter group comparison of extension active showed no significant effect in group A compared to group B.

The study done by Shruti Naik provided immediate improvement in shoulder pain, range of motion and the functions in 5 consecutive sessions. Adding both the conventional therapy and MDT have reduced manifestations of adhesive capsulitis, mainly in improving Pain, ROM and functions.^[26] All the ranges showed statistical difference in the present study. The study correlated with the study conducted by Aina and May^[20,26] where repeated movements were able to abolish symptoms and restore full pain free range of motion in the shoulder joint. MDT technique applied to shoulder derangement syndrome and improvement was noted which can be because of repeated end range loading in appropriate direction, termed directional preference in pain reduction and improving range.

According to Aina and May repeated movements during MDT technique causes stimulation of the mechanoreceptors and hence abolishes pain and improves ROM because of overpressure applied at the available end range.^[20,27]

According to Littlewoods and May,^[40] during MDT treatment pain will be persistent until the tissues are remodelled, which is done usually by loading the impairment with active and resisted movements. Loading must be sufficient enough to produce a degree of pain that settles once repeated movements are ceased.

According to literature, the conventional exercises in patients with adhesive capsulitis proved effective in reduction of pain and increasing the range of motion in the shoulder joint. It is noted that exercises within the pain free range of motion stimulate the mechanoreceptors and hence reduces the pain in the joint and also help in movement of the synovial fluid and

thus decreases the inflammation and decreases the pain. These exercises use the effects of gravity to distract the humerus from the glenoid fossa which helps to relieve pain by gentle traction and oscillations. The pain reduction is also through the mechanical and neurophysiological effect. Hence it shows that conventional exercises help in improving ROM and pain reduction. In the present study conventional exercise therapy have helped in improving ROM, pain reduction and better shoulder functions^[26]

Limitations: Examiner was not blinded, follow up was not done, all stages of adhesive capsulitis were taken, Comparison of abduction and extension passive range was not done.

Scope for Future Studies: Large sample size can be taken, Blinded study can be done, only one stage of adhesive capsulitis can be studied to see the effect.

CONCLUSION

This study concludes that McKenzie exercise along with convention exercise is effective in increasing range of motion and reducing disability compared to control group.

McKenzie exercise with conventional exercise and conventional exercise are both effective to reduce pain.

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